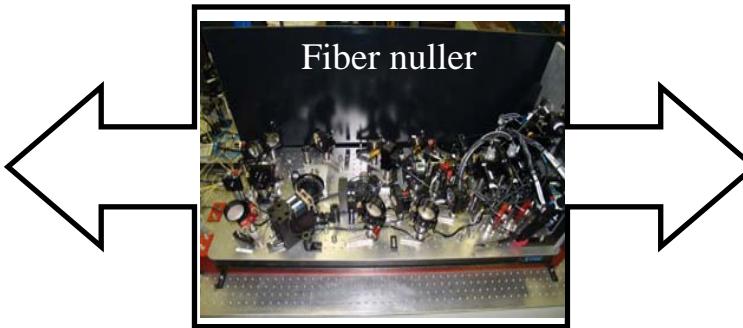


The Fiber Nuller : Detecting faint companions close to bright stars

PI: Gene Serabyn
C. Hanot, K. Liewer, F. Loya, S. Martin, D. Mawet

1. Project Objectives



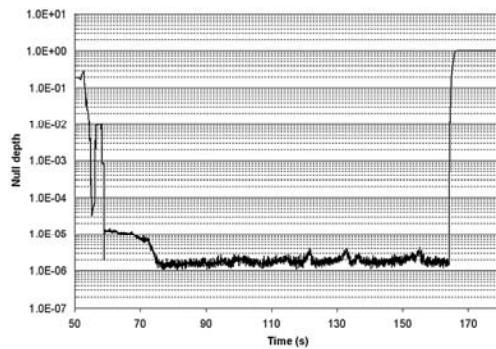
- Demonstrator for **TPF-I** : First ground-based **rotating nulling interferometer**.
- Coronagraphy : Very low **inner working angle** coronagraphic system.
- Science : Detection of **faint off-axis companions** (from binary stars to brown dwarfs).



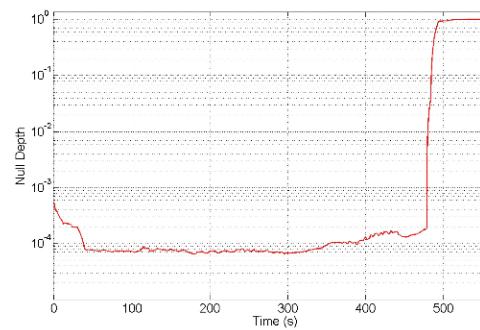
2. Recent results

Experiment	λ range [nm]	Best of Fiber Nuller nulls
Lab	632.8	$\sim 770,000 : 1$
Lab	[1500;1800]	$> 10,000 : 1$
Palomar AO lab *	[2000;2400]	$\sim 100 : 1$

* Results obtained with the deployable fiber nuller mounted directly under the adaptive optics system of the 200" Hale telescope in the Palomar AO lab.



632.8 nm laser null

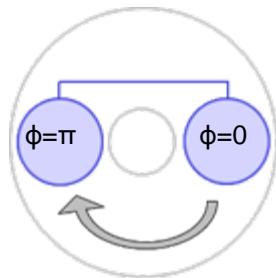


H-band null

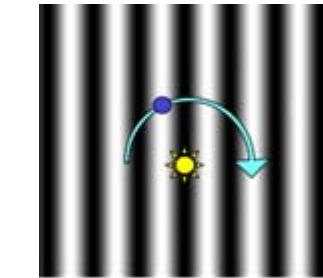
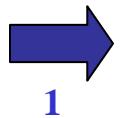
The Fiber Nuller : Detecting faint companions close to bright stars



3. Principles



Rotation of the baseline



Rotation of the fringe pattern

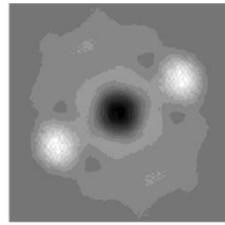
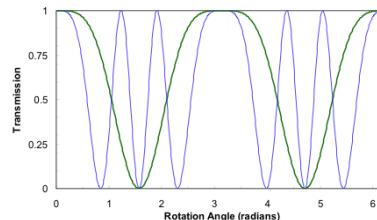
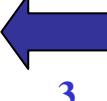


Image reconstruction



Modulation of off axis companion

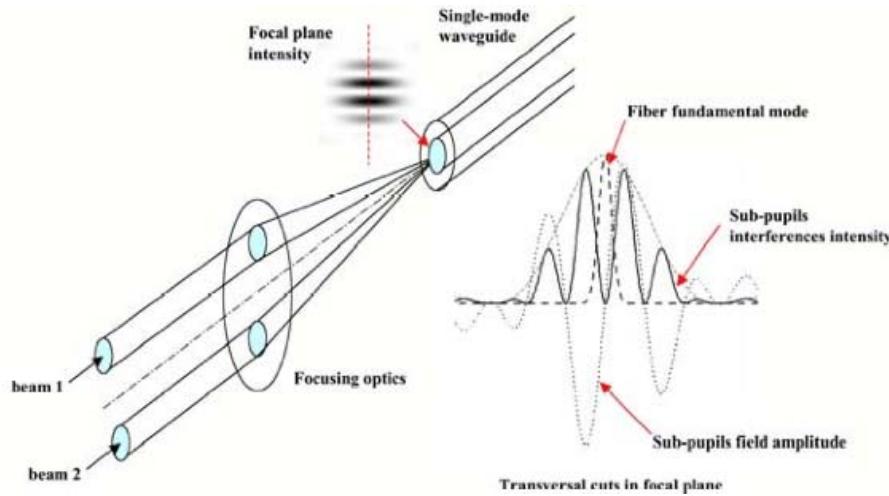


The fiber noller will be the first experiment to demonstrate this technique.



4. Current status

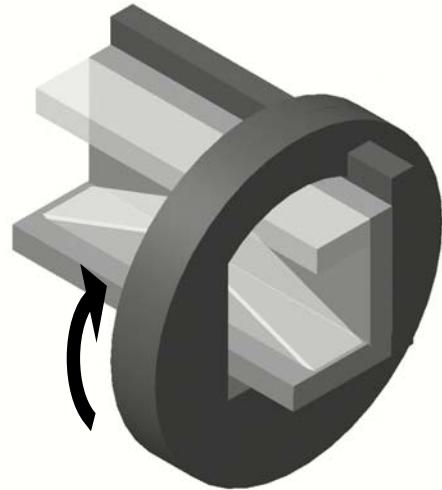
- Deployable bench operational
- Improvement of the beams intensity balance as well as the background noise (chopping wheel)
- Throughput optimization
 - Comparison of ≠ single-mode fibers throughput
 - Optimization of the fiber nuller layout
- Optimization of the injection into the single-mode fiber





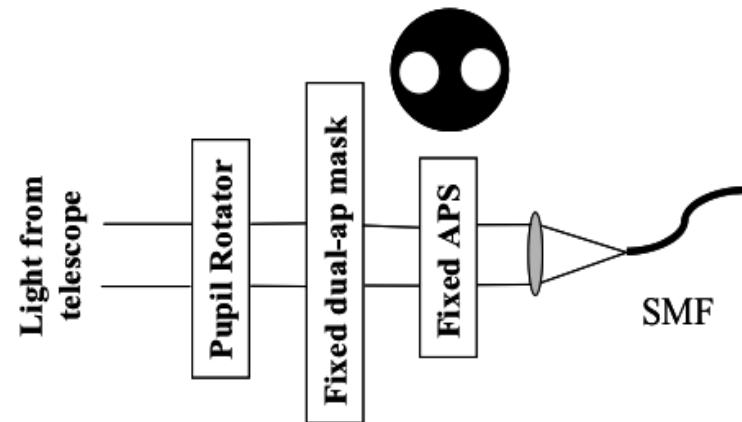
4. Current status

- Implementation of the pupil-rotator



Pupil rotator (K-mirror)

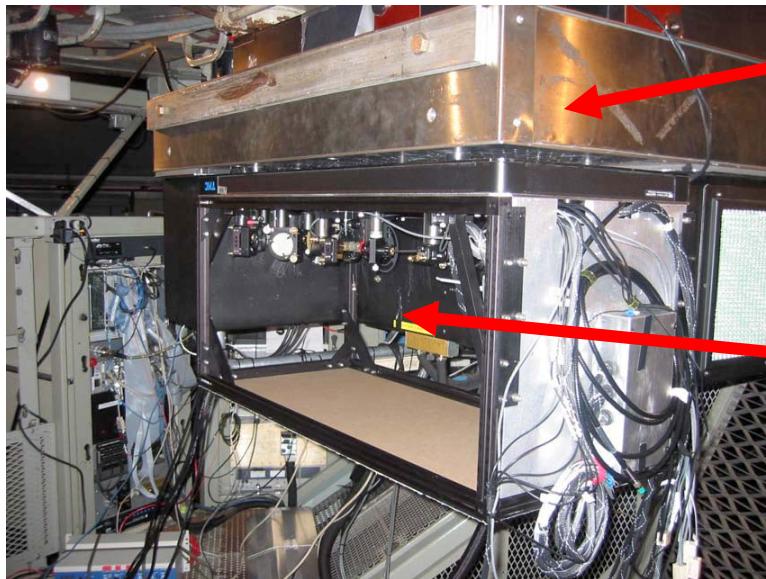
Layout of the rotating nullder





5. Future

- Next engineering time in July 2008
 - Alignment of the nuller
 - First nulling observation with a rotating baseline



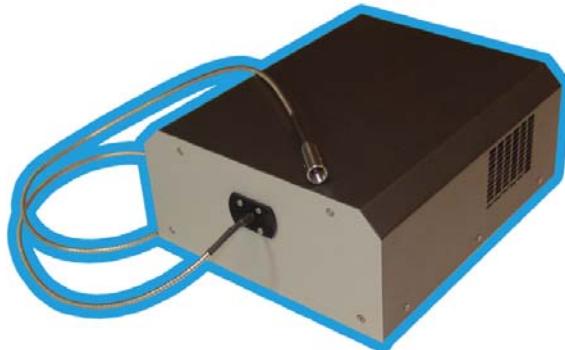
Adaptive optics

Deployable fiber nul'

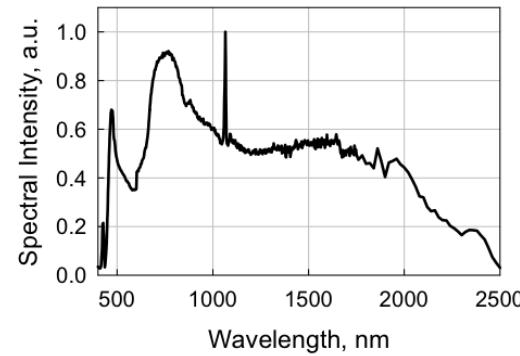


5. Future

- Possible upgrade of our experiment



Supercontinuum white
light source



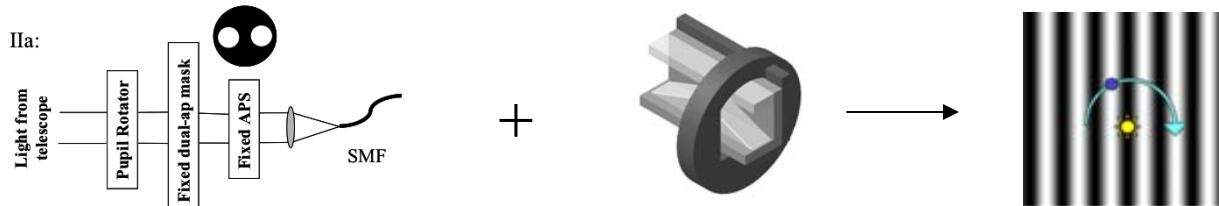
- Broadband (Y,J,H and K bands)
- More flux ($>10^3$) so we can measure deeper nulls
- The source can be re-used for other high-contrast experiments

The Fiber Nuller : Detecting faint companions close to bright stars

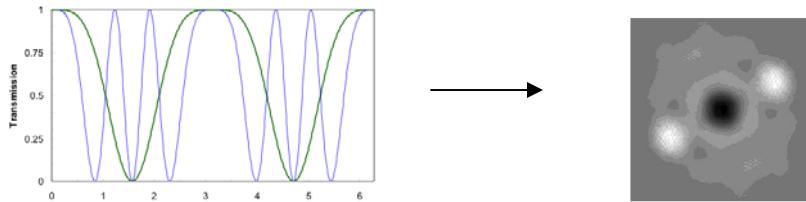


6. Benefits to NASA and JPL

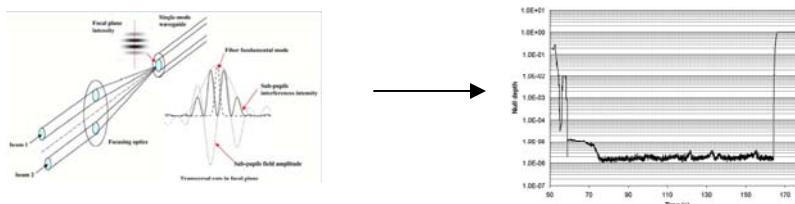
- First demonstration of the **rotating baseline-nuller concept** : TPF-I (NASA) and DARWIN (ESA).



- First **off-axis source detection** with a rotating nullder : major step forward for TPF-I.



- First demonstration of the **fiber nullder method for beam combination**.



- Interest for **coronagraphic missions** such as TPF-C, Eclipse, GIMLI, etc...